Reasoning and Comprehension Processes of Linguistic Minority Persons Learning from Text

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Executive Summary of the Final Report

The three-year project "Reasoning and Comprehension Processes of Linguistic Minority Persons Learning from Text" has investigated processes and strategies of students for whom English is a not the native language (ESL) as they negotiated the demands of learning from academic texts. For comparative purposes, we also examined the processes and strategies of native English speaking students. Our initial work was largely exploratory and descriptive. We began our investigations with talk-aloud protocol studies of the strategies students use to answer questions from Oceanography and Psychology textbooks commonly used in introductory level courses. (Goldman & Durán, 1987; 1988).

Several important results emerged from the Oceanography work. In particular, native English speaking students who had a relatively good knowledge base for science concepts used in Oceanography performed better on the Oceanography materials than students who had little or no relevant prior knowledge. The strategies used by students with more knowledge of oceanography were different from those with less knowledge: the former relied on memory to generate an initial answer to questions and examined the text to confirm the answer. The latter essentially used a word-matching strategy wherever possible. They based their answer on a supposedly relevant section of the text identified by matching the words in the question to the words in the text. Not surprisingly, the most difficult questions to answer were those where more than one section of the text had matching words and information had to be integrated to answer the question adequately.

The processing differences between higher and lower content knowledge native English speakers were generally replicated in the ESL students. However, all the ESL students tended to rely more heavily on the text, searching it for greater periods of time than did the native English students. In the course of those searches, the protocol data indicated that lower knowledge base students often had an imprecise understanding of key terms that made their overall understanding of a question (and of the text) imprecise. During the question answering process ESL students also showed a greater incidence of monitoring and evaluating behavior than the native English speakers, and this was especially noticeable for individuals with high and medium knowledge of subject matter.

By far, the most difficult questions for all students were those that required the application of textbook information to a new situation and those questions that paraphrased statements in text (and for which a matching strategy would be unsuccessful). One of the text design implications of the results of the Oceanography study is that the difficulty of a question cannot be determined in isolation from the linguistic form in which information relevant to the answer has been imparted. But ability to thoroughly decode and process linguistic form may not impair the ability to answer questions among some ESL students. The data suggest that ESL students with high levels of domain-specific knowledge may compensate for less than perfect proficiency in English by activating knowledge of principles and facts relevant to questions based on contextual cues discerned in the text and questions.

The protocol studies also suggested that certain discourse structures were particularly problematic for students, especially ESL students. In the second and

third years of the project more controlled experimental studies of these structures were conducted. Specifically, several types of logical connectors were examined.

In five experiments we examined the effects of sequence markers on text comprehension and memory. Sequence markers are rhetorical devices that signal individual elements of a list. They operate at the level of the entire passage and their presence ought to make it easier to understand the logical flow or organization of the passage. Summarizing over the results of four studies, explicitly enumerated points were remembered better by both native English and ESL students (Goldman, 1988c). We used reading time data and a "trace" of the order in which sentences had been read, to infer the reading strategies of the students. The reading time data and the traces were collected using the specially developed software package *Readit!* (Saul, Pohl & Goldman, 1988). We identified three global strategies: Read all the way through and quit (Type 1); Read all the way through then go back and reread portions of the text (Type 2); Stop and reread as you go through the text (Type 3). Consistent with the findings of strategy use in other domains in the present research, students were found to use a mixture of reading strategies regardless of language background. Also, the proportion of passages read with each global strategy was similar across language groups.

Ten backtracking or rereading strategies were identified, and varied in terms of the amount of text reviewed and whether this material was skimmed rather than read. ESL students engaged in more rereading than did the native English students, but the relative frequency of the different strategies was similar for both groups. We also found that the ESL students spent more time reading the passages than the native English students. The backtracking strategy data indicated that at least some of this time is accounted for by a greater frequency of active review of previously read material, perhaps because the students realized that adequate comprehension was not occurring.

The fifth study in this series investigated comprehension monitoring by ESL and native English students. It examined the effects of enumerating some --but not other --sentences within the same short passage. The specific predictions were that backtracking would be related to gaps in the enumeration of four target points in a text. For example, in one condition, the first and third points in a four point text were preceded by the words *First* or *Third*, respectively while the occurrence of the second point was not marked by occurrence of a sequential connector. When the student read "Third..." if they were monitoring their understanding, they should have backtracked to try and find the second point. This backtracking should occur if readers are using the enumeration signals to aid their construction of an internal representation of the text *and if* they have not already detected and comprehended a second point. That is, readers with sufficient skill may recognize the occurrence of the second point even without an explicit marker, and thus the explicit marker would not affect their reading behavior.

The recall data indicated that marking the points with specific enumerators had a small positive effect on the recall of some of the target points in two groups of readers, the native English and the more advanced ESL (ESL2) students. There was no effect on the recall of the least advanced ESL students (ESL3). Effects of marking in the ESL2 and native English groups varied. Marking did not affect recall of the first point after an introductory topic sentence. Recall of the second point was greater when it was marked than when it was unmarked and this effect was greater for the ESL2 than for the native English students. Recall of point three was not boosted by marking; however, recall of the fourth point was boosted by explicit marking. Overall, the effects of sequential marking on recall were not terribly large, with students recalling about 50% of the points regardless of marking. However, the marking manipulation did lead to increases in the amount of time spent reading the marked

sentences, especially for sentences occurring later in the paragraph.

Enumeration devices signal the sequence of information in a text. In addition to sequential markers, three other types of connectors frequently occur in text: *Additives* (e.g., *in addition to, furthermore*) signal the elaboration of previously introduced concepts; *Adversatives* (e.g., *but, however*) indicate a disjunction or logical contrast in the information; *Causals* (e. g., *because, as a result*) indicate a cause-effect antecedent-consequent relationship between information. In three studies, a cloze, multiple-choice procedure was used to examine the ability of ESL and native English speakers to select appropriate connectors between adjacent clauses occurring in informational text (Goldman & Murray, 1989).

The native English speakers were more frequently correct than the ESL students, however, the patterns of difficulty across the connector types were similar for the two groups. For all students, cloze completion responses were most often correct when additive or causal connectors were required. Native English speakers' confidence ratings of correct responses were higher for adversative and sequential connectors than for causal and additive connectors but there were no differences in the confidence ratings of the ESL students. When students answered incorrectly, they tended to choose causal and additive distractors. Protocol analysis procedures were used to investigate students' understanding of the semantic fit of alternative connector choices. For both native English and ESL students, justifications of correct choices indicated appropriate understanding of the functions of the various connectors and the differences among them. Justifications for the incorrect responses suggested two major reasons for errors: (1) incorrect inferences abnout the appropriate logical relation, and (2) an inability to select the connector that expressed those incorrectly inferred relations in context.

The studies of logical connectors indicated that ESL students were aware of the meaning and function of many connector terms. Determining the logical relation that obtained between elements in informational text was a major source of difficulty for ESL students. That ESL students understood the meaning-in-isolation of many of the specific instances of connectors implies that the presence of these cohesive devices may be extremely important to the comprehension of ESL students.

In general, the studies conducted under the auspices of this project suggest that the strategies that ESL and native English speakers attempt to use when they read text are similar. Furthermore, most individuals in each group demonstrated flexibility in the strategies they used for comprehension. Differences in performance appeared to reside in the likelihood that the strategy produced the "correct" result and in processing efficiency. Important questions for subsequent research are those that address (1) the nature of the cognitive, motivational and attitudinal costs of inefficient processing, and (2) the developmental course of efficient processing in English by ESL speakers.

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